Mark schemes

Q1.

(a) $6O_2 + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2$

1

(b) mitochondria / mitochondrion

1

(c) any **two** from:

- movement / muscle contraction
- keeping warm
- active transport
- building larger molecules

ignore reference to metabolism unqualified

allow examples of movement

allow examples of building larger molecules e.g. making (named) proteins / cellulose

allow cell division

ignore growth

2

(d) any **two** from:

- anaerobic produces lactic acid **and** aerobic does not

*allow anaerobic creates an oxygen debt **and** aerobic does not*

- aerobic produces carbon dioxide **and** anaerobic does not
- aerobic produces water **and** anaerobic does not
- aerobic occurs (mainly) in the mitochondria **and** anaerobic does not

*allow anaerobic **only** occurs in the cytoplasm*

- anaerobic releases less energy than aerobic

allow anaerobic releases less ATP (than anaerobic)

*do **not** accept anaerobic produces / makes / creates less energy*

2

(e) carbon dioxide

1

ethanol

1

(f) pondweed takes in CO_2 for photosynthesis

1

snail **and** pondweed are respiring producing CO_2

*if no other mark awarded allow rate of respiration = rate of photosynthesis for **1** mark*

1

(g) (no light so) no photosynthesis
or
plant is not taking in CO_2

and

snail **and** plant are respiring and so are releasing CO_2

1

(h) snail is being decayed / decomposed / broken down
ignore being fed on

1

(by) decomposers / bacteria (in pond water / snail)
allow fungi / microbes / microorganisms

1

(therefore) respiration (of decomposers / bacteria) releases CO_2
*do **not** accept anaerobic respiration*

1

[14]

Q2.

(a)

Factor	Biotic	Abiotic
Nitrates in the soil		✓
Rabbits eating the plants	✓	
Shading by a building		✓
Soil pH		✓
Temperature		✓
Trampling by people	✓	

all 6 correct = **3** marks
4 or 5 correct = **2** marks
2 or 3 correct = **1** mark
0 or 1 correct = **0** marks 3

3

(b) (grid and) coordinates

1

to achieve randomness

ignore throwing quadrat

*allow random coordinates for **2** marks*

*if no other mark awarded allow random walk **or** description of random walk for **1** mark*

1

(c) *(mean per m^2 =)*
24 **or** 6 × 4

1

(calculation of area of lawn =) (½ × 16 × 10) – (6 × 3)
or 80 – 18

1

(area of lawn =) 62 m^2

allow correct calculation using total area (of triangle) – area of rectangle

(total number of daisies =)
24 × 62

allow correct calculation using an incorrectly calculated area of the lawn and / or mean

1

1488

allow answer based on incorrect area

1

(answer to 3 sig figs =) 1490

allow student's calculated answer rounded to 3 sig figs

1

(d) too few quadrats **or** quadrat too small

allow sample size too small

1

sample may not be representative of the lawn

allow quadrats may not have been placed randomly

1

[13]

Q3.

(a) *before arrow*
carbon dioxide **and** water

allow correct chemical symbols

ignore any attempt at balancing equation

ignore light / chlorophyll

either order

1

after arrow

glucose

ignore sugar / carbohydrate
*do **not** accept starch*

1

(b) light

ignore description of subsequent parts of the photosynthesis reaction
allow sunlight
ignore sun

1

(light) is captured / trapped / absorbed by chlorophyll / chloroplasts

allow (light) is used by chlorophyll / chloroplasts

1

(c)

$$\frac{(18.5 + 19.3 + 19.5)}{3}$$

or

$$\frac{57.3}{3}$$

1

19.1 (cm^3/hour)

allow an answer correctly calculated using only two correct values

1

(d) a ring around 14.2

allow clear indication of correct result

1

(e) any **one** from:

- scale / value was misread

  ignore human error
  ignore references to counting bubbles or time
  allow measurement error

- there was air / oxygen in the syringe / measuring cylinder / apparatus

- the lamp / light was moved

  allow light intensity changed ignore different bulb / lamp unqualified

- temperature changed
- had different mass / length of pondweed
- pondweed had not acclimatised

1

(f) did not use it in calculation (of mean)

1

(g) any **one** from:

- light (intensity)
  *do **not** accept temperature*
  ignore time
  allow distance / power / colour of lamp / light
- carbon dioxide (concentration)
- pondweed size / amount
- pondweed species
  allow same (piece of) pondweed

1

(h) enzyme(s) lose the shape of the active site
allow enzyme(s) (start to) denature
allow enzyme(s) destroyed / damaged
*do **not** accept enzyme(s) killed*

1

(i) y-axis labelled '(rate of) photosynthesis in cm^3/hour'

1

suitable scale on y-axis
must take up half or more of grid provided

1

all points plotted to within ± ½ small square
*allow 3 or 4 correct plots for **1** mark*
ignore any attempt to plot a point at 20 °C

2

correct curved line of best fit
ignore line joined point to point with straight lines
ignore extrapolation

1

[16]

Q4.

(a) fatty acids

1

glycerol

1

(b) enzyme binds to the substrate because they are complementary (shapes)

allow enzyme joins to the substrate because they fit together exactly

allow enzyme joins to the substrate because the substrate fits the active site

*ignore reference to specificity do **not** accept same shape*

1

(so) substrate is broken down (into products)

allow (so) substrate splits (into products)

ignore products are formed, unqualified

1

(so) products are released **or** enzyme is not changed

allow enzyme is not used up

*allow reference to activation energy for either marking point 2 **or** marking point 3*

1

(c) each <u>active site</u> has a specific shape (so only fits one type of lipid molecule)

allow each <u>active site</u> is a different shape

*do **not** accept reference to the substrate having an active site*

1

(d) add Benedict's (solution / reagent to the liquid)

1

boil / heat

allow any temperature of 65 °C or above

1

(if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick) red

1

(e) add iodine solution / reagent (to the liquid)

allow add a drop of iodine

ignore iodine unqualified

1

(if starch is present) it changes colour to blue / black (from yellow / orange / brown)

1

(f) glucose from photosynthesis

*do **not** accept starch made in photosynthesis*

1

(excess) glucose converted to starch

allow (excess) glucose is stored as starch

1

(g) starch (stores) have been converted to glucose

ignore reference to residual glucose from previous photosynthesis

1

(so the glucose can be) used for respiration / (named) metabolic reactions
or (so the glucose can be) used to release energy

*do **not** accept idea of energy being produced / created / made*

1

(because) there is no light to make (new / more) glucose by photosynthesis

1

(h) any **one** from:

- test roots / stems of plants (in the light and dark)

  *do **not** accept reference to changing the independent variable*

  allow test other parts of the plants
- test other species of plant

  allow test other types of plant
- measure the concentrations of glucose **and** starch

  ignore mass / amount
- vary the time in the dark / light
- test variegated leaves

  allow any other valid extension ignore repeats

1

[17]

Q5.

(a)

words take precedence over symbols

LHS:

1

carbon dioxide **and** water

RHS:
glucose

1

allow correct symbols (ignore balancing)

in any order

*do **not** accept starch*

ignore carbohydrates / sugar

(b) power output of bulb

1

(c) any **two** from:

- repeat **and** calculate a mean
  or
  repeat **and** to eliminate anomalies
  ignore do a control experiment unqualified
- control the (water) temperature
  allow a method of controlling (water) temperature
- control the concentration of carbon dioxide
  allow a method of controlling carbon dioxide concentration
- control the distance of the bulb from the pondweed
- control the mass / length / species / age of the pondweed
  allow use the same piece of pondweed
- give pondweed time to equilibrate
  allow do experiment with the bulb off / in the dark

2

(d) 3.3 (cm^3/hour)

1

(e)

*max **3** marks for bar chart*

correct scale **and** axis labelled

1

all points plotted correctly

allow points plotted to within ± ½ small square
*allow 3 or 4 correct plots for **1** mark*
*allow correct plot from incorrect value calculated in part **(d)***

2

correct curved line of best fit

ignore line extended beyond 60 / 250 (W)
ignore line joined point to point with straight lines

1

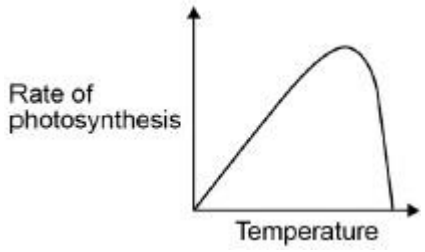
(f) correct answer from their line drawn on **Figure 2**

allow ± ½ small square tolerance

allow 1.8 / 1.9 if no line of best fit or incorrect graph is drawn

1

(g)



1

[12]

Q6.

(a) rate of photosynthesis increases
or
number of bubbles produced (in one minute) increases
or
volume of gas / oxygen produced (in one minute) increases

allow decreases / stays the same throughout

1

(b) light intensity

1

(c) reduces the effect of heat from the lamp
or
prevents temperature affecting photosynthesis

1

(d) 52

1

(e) should be 62
or
is to 3 s.f. / not rounded

allow inconsistent number of significant figures / decimal places

1

(f) the numbers of bubbles at each distance are similar

1

(g) x-axis correctly labelled (colour of light) **and** bars identified as correct colour

bars can be identified by labels beneath the x-axis or with a key

1

bars plotted correctly

*all 4 correct = **2** marks 3 correct = **1** mark*

*if wrong type of graph drawn, max **2** marks*

2

(h) blue light gives highest (rate of) photosynthesis

allow ecf from candidate's graph allow blue light is best

1

green light gives the lowest (rate of) photosynthesis

allow green light is worst

1

(i) energy

in this order only

1

cell wall(s)

allow cell

*do **not** accept (cell) membrane*

1

starch / fat / oil / lipid

1

[14]

Q7.

(a) correct figures from graph: 5.0 / 5 and 2.60 / 2.6

2.40 / 2.4

*an answer of 2.40 / 2.4 scores **2** marks*

1

*allow correct answer from candidate's figures from graph for **1** mark*

1

(b) $\frac{1}{3}$

1

(c) protein

1

(d) a genetically-modified variety of seed was sown in 2004

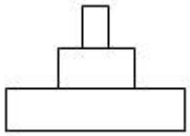
1

more rain fell in spring and early summer in 2004

1

the mean summer temperature was lower in 2003

1

(e) 

1

(f) 80

1

(g) chickens use energy for movement and for keeping warm

1

much of the food eaten by chickens is wasted as faeces

1

[11]

Q8.

(a) carbon dioxide

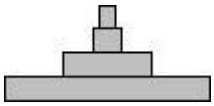
1

water

1

(b) light

1

(c) 

1

(d) 2.3 **and** 0.5

allow figures in millions
allow in range 2.25 to 2.3 for 2.3
allow in range 0.5 to 0.55 for 0.5

1

$\frac{(2.3 - 0.5)}{2.3} \times 100$ **or** $\frac{1.8}{2.3} \times 100$

allow correct substitution of student's incorrect graph readings

1

78.2(6087....)

allow correct answer from student's substitution of incorrect graph readings
ignore incorrect rounding

1

78

allow correct rounding of calculated value

1

(e) increase (in biomass of herring)

1

from 0.1 to 1.8 (million tonnes)
or
change of 1.7 (million tonnes)
or
change of 1700%

allow a tolerance of ± ½ small square for graph readings

1

(f) smaller / 4-yr-old fish not caught

allow younger fish not caught
allow (only) older fish caught

1

(so) escaping fish can reproduce

allow so younger fish can survive to reproduce

1

[12]

Q9.

(a) will stop animals / herbivores eating it

allow it will not be eaten

1

(b) chemical

1

(c) thorns / spikes / spines / prickles (to stop animals / herbivores eating it)

1

(d) for respiration

1

to store as starch

1

(e) add Benedict's (solution / reagent to the liquid)

1

boil / heat

allow any temperature of 65 °C or above

1

(if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick) red

1

(f) (nitrate ions are needed) to make proteins / amino acids

allow to make chlorophyll / DNA / ATP /

nucleic acid

1

which are needed for growth / enzymes / new cells

allow correct process for named molecule in mp1

1

(g) in / on the (soil) water

allow through air (spaces) in the soil

1

(h) dosage

1

toxicity

1

(i) placebos

1

[14]

Q10.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

Level 3 (5–6 marks):
A description of how the apparatus is used to measure the **rate** of photosynthesis at different light **intensities** is given.

For full marks reference must be made to a control variable
or
repeats

Level 2 (3–4 marks):
A description of how the apparatus is set up
and
a description of how photosynthesis can be measured.
or
a description of how light intensity is varied
or
a control variable **or** any other relevant point

Level 1 (1–2 marks):
A partial description of how the apparatus is set up
or
a description of how light is supplied
or
a simple description of how photosynthesis can be measured.
or
a control variable

0 marks:

No relevant content.

examples of the points made in the response:

- apparatus set up:
  – weed in water in beaker
  – light shining on beaker
- method of varying the light intensity–eg changing distance of lamp from plant
- method of controlling other variables
  – use same pond weed **or** same length of pond weed
  – temperature: water bath or heat screen
  – CO_2
- leave sufficient time at each new light intensity before measurements taken
- method of measuring photosynthesis – eg counting bubbles of gas released or collecting gas and measuring volume in a syringe
- measuring **rate of photosynthesis** by counting bubbles for set period of time
- repetitions

extra information:

allow information in the form of a diagram

[6]